21. Wolitski RJ, Kidder DP, Fenton KA. HIV, homelessness, and public health: critical issues and a call for increased action. *AIDS Behav.* 2007;11(suppl 6):167–171.

22. Kidder DP, Wolitski RJ, Royal S, et al. Access to housing as a structural intervention for homeless and unstably housed people living with HIV: rationale, methods, and implementation of the housing and health study. *AIDS Behav.* 2007;11(suppl 6):149–161.

23. Brewer TH, Mullings M, Cardenas G, Zenilman J, Metsch LR. Crack cocaine use and utilization of HIV primary care. Poster presented at: 15th International AIDS Conference; July 11–16, 2004; Bangkok, Thailand.

Associations Between Availability and Coverage of HIV-Prevention Measures and Subsequent Incidence of Diagnosed HIV Infection Among Injection Drug Users

Lucas Wiessing, MSc, Giedrius Likatavičius, MD, Danica Klempová, MA, Dagmar Hedrich, MSc, Anthony Nardone, PhD, and Paul Griffiths, MSc

HIV-prevention measures specific to injection drug users (IDUs), such as opioid substitution treatment and needle-and-syringe programs, are not provided in many countries where injection drug use is endemic. We describe the incidence of diagnosed HIV infection in IDUs and the availability and coverage of opioid substitution and needle-and-syringe programs in the European Union and 5 middle- and high-income countries. Countries with greater provision of both prevention measures in 2000 to 2004 had lower incidence of diagnosed HIV infection in 2005 and 2006. (*Am J Public Health.* 2009;99:1049–1052. doi:10.2105/AJPH.2008.141846)

In many countries where injection drug use is endemic, structural and legal difficulties preclude the provision of HIV-prevention measures specific to injection drug users (IDUs), such as opioid substitution treatment and needle-and-syringe programs.[1–8] To determine whether there was an association between HIV incidence among IDUs and IDU-specific HIV-prevention measures, we compared the provision of IDU-specific prevention measures ("harm reduction" measures) to IDUs from 2000 to 2004 with diagnosed HIV incidence among IDUs from 2005 to 2006 in the European Union (EU) and 5 middle- and high-income countries.

METHODS

For our study, we chose countries that had contrasting policies on HIV prevention among IDUs, country-level data available on diagnosed HIV incidence among IDUs, and country-level data on the availability of opioid substitution treatment and needle-and-syringe programs as well as data on the extent of use of those programs' services by IDUs ("coverage"). The countries selected were from North America (the United States and Canada), eastern Europe (the Russian Federation and Ukraine), the 27 countries in the EU, and Australia.

We assessed availability of opioid substitution treatment and needle-and-syringe programs through an online literature review of PubMed (http://www.ncbi.nlm.nih.gov/pubmed) and other relevant Web sites. Where possible, we calculated the coverage of opioid substitution treatment and needle-and-syringe program services by dividing intervention data (number of clients on opioid substitution treatment or number of syringes distributed) by the nearest-year estimated number of opioid users or IDUs during the period 2000–2005.[9]

Estimates of needle-and-syringe program coverage for Canada and the United States were based on different definitions. To calculate diagnosed HIV incidence among IDUs in a given year, we divided the number of diagnosed HIV cases among IDUs by the total population. Data for Australia and Canada were for year of HIV diagnosis; data for the EU, the Russian Federation, Ukraine, and the United States were for year of report. HIV diagnoses for the EU were an estimate adjusted for 2 countries that did not report national data (Spain and Italy).

RESULTS

The data point to important differences in the incidence of diagnosed HIV infection among IDUs (Table 1). The situation in the EU, Australia, and Canada (<10 new cases per million population in 2005–2006) appears favorable in comparison with the United States (18 cases per million in 2005), whereas higher rates are reported in Russia (72–79 cases per million in 2005–2006) and Ukraine (134–153 cases per million in 2005–2006). Of the 25 EU countries that provided national data for 2006, 18 countries reported an incidence of fewer than 5 newly diagnosed IDU-related HIV cases per million population. Information on the availability of opioid substitution treatment and needle-and-syringe programs is less clearly defined but also appears to show large variation.[12,15–17]

In the 27 EU countries, opioid substitution treatment and needle-and-syringe programs have generally been available since the late 1990s. In some EU countries (e.g., the United Kingdom and the Netherlands), opioid substitution treatment and needle-and-syringe programs became available much earlier than that. All but 2 EU countries (Cyprus and Estonia) had introduced methadone maintenance treatment by 2000. Approximately 1 in 3 opioid injectors in the EU were covered by opioid substitution treatment by 2004. By 2003–2004, 26 EU countries had introduced needle-and-syringe programs. Where data were available, they suggested an average needle-and-syringe program coverage rate of 52 syringes per estimated IDU per year in the EU.[15,17]

In Australia and Canada, opioid substitution treatment and needle-and-syringe programs have also been generally available since well before 2000.[18–21] In Australia some 30.8 million needle and syringe units were distributed to an estimated 80 000 regular IDUs in 2004,[22] resulting in an average of 385 units per IDU. An estimated 39 000 opioid users in Australia received opioid substitution treatment in 2006. In Canada in 1998, needle-and-syringe programs met 20% of the estimated need for sterile injections in Vancouver; in Montreal, the figure was

TABLE 1—IDU Prevalence, Diagnosed HIV Incidence Among IDUs, Availability and Coverage of OST and NSPs, and Pharmacy Sales of Needles or Syringes, by Country: European Union (EU) and 5 Selected Middle- and High-Income Countries, 2000–2006

	IDU Prevalence		Diagnosed HIV Incidence Among IDUs, 2005		Diagnosed HIV Incidence Among IDUs, 2006		2000–2004[a]		
	Data Collection Year and IDU Status	% (Range) or % (95% CI)[b]	No. Cases	Rate/ Million	No. Cases	Rate/ Million	Availability of OST, (Year and Coverage Among Opioid Users)	Availability of NSPs, (Year and Coverage Among IDUs)	Pharmacy Sales of Needles or Syringes
Australia	2005, current IDU	1.09 (0.65–1.50)	33	1.6	28	1.4	OST available (2006: ~50%)	NSPs available (2004: 385 syringe/needle units per estimated IDU)	Unrestricted
EU (27 countries)	2002–2006, data from 10 countries, current IDU	0.19 (0.16–0.21)	3120	6.4	2907	5.9	OST available (2000: ~22%; 2004: ~33%)	NSPs available (2003–2004: 53 syringes per IDU per year, data from 11 countries)	Unrestricted (except Sweden)
Canada	2004, lifetime IDU	1.3 (1.0, 1.7)	237	7.2	241	7.3	OST available (2003: ~26%)	NSPs available (1998: 5% of injections covered in Montreal; 20% of injections covered in Vancouver)	Unrestricted
United States[c]	2002, current IDU	0.96 (0.67, 1.34)	3904 (38 states and dependent areas)	18 (38 states and dependent areas)	NA	NA	OST available (1998–2004: 15%–25%)	NSPs restricted (1996–2000: ~3% of injections covered)	Restricted in most states
Russian Federation	2007, current IDU	1.78 (NA)	10 283	72	11 161	79	OST not available	NSPs restricted (2001–2002: ~2.6 syringes provided per estimated IDU; 1%–4% of IDUs in contact with NSPs)	Unrestricted (but carrying syringes punished)
Ukraine	2006, current IDU	1.16 (1.00, 1.31)	6270	134	7127	153	OST mostly unavailable (~1%)	NSPs restricted (2001–2002: ~7.5 syringes provided per estimated IDU; 8% of IDUs in contact with NSPs)	NA

Note. IDU = injection drug user; OST = opioid substitution treatment; NSP = needle-and-syringe program; NA = not available.

Source. IDU prevalence data for non-EU countries were taken from Mathers et al.[10] IDU prevalence data for the EU were taken from the European Monitoring Centre for Drugs and Drug Addiction (Wiessing et al., 2008). HIV data for Australia were taken from the National Centre in HIV Epidemiology and Clinical Research.[11] HIV data for the EU, the Russian Federation, and Ukraine were taken from EuroHIV.[12] HIV data for Canada were taken from the Public Health Agency of Canada.[13] HIV data for the United States were taken from the Centers for Disease Control and Prevention.[14] Population data for the EU were taken from Eurostat (http://epp.eurostat.ec.europa.eu). Population data for other countries were taken from the US Census Bureau (http://www.census.gov). EU data reported here other than diagnosed HIV cases and population data are annually reported to the European Monitoring Centre for Drugs and Drug Addiction by the Reitox National Focal Points network (http://www.emcdda.europa.eu/html.cfm/index403EN.html).

[a]Or nearest period available.

[b]The percentage ranges include both 95% confidence intervals and ranges based on modeling or sensitivity analysis. They should not be compared between countries.

[c]HIV data for the United States in 2006 are not comparable with data for 2005 because they cover different states and include states that reported cases for only part of 2006.

5%.[23] Around 26% of opioid users in Canada received opioid substitution treatment in 2003.[24]

In the United States, opioid substitution treatment has long been available. We estimated that 15% to 25% of the up to 1 million addicted opioid users in the United States were enrolled in methadone treatment between 1998 and 2004.[25–27] Needle-and-syringe programs have also been available in the United States, although they have been concentrated in a few states. Federal funding of needle-and-syringe programs has been prohibited since 1988.[28,29] By the late 1990s, it was estimated that national needle-and-syringe program coverage met around 3% of the need for this service.[30]

In Russia, opioid substitution treatment is not available, and it has been estimated that between 1% and 4% of IDUs are in contact with needle-and-syringe programs.[31,32] A study among 1473 IDUs in 3 Russian cities found that 93% reported obtaining their needles mainly from pharmacies. Only 7% of respondents had ever had contact with syringe-exchange projects.[33]

In Ukraine, provision of opioid substitution treatment has been low, with around 1% of opioid users enrolled until 2007. Needle-and-syringe program coverage was about 7.5 syringes per estimated IDU per year in 2001–2002.[31,32,34]

Pharmacy sales may form an important complement to needle and syringe availability through needle-and-syringe programs.[35] Sales are legally unrestricted in Australia, the EU (except for Sweden),[15,17] and Canada, but are mostly restricted in the United States.[35] In Russia, although sales are not legally restricted, carrying syringes or needles can lead to severe punishment, including imprisonment. Pharmacy sales information was not available for Ukraine.

DISCUSSION

Important differences existed among these countries in the availability and coverage of HIV-prevention measures for IDUs in 2000–2004, and in the incidence of diagnosed HIV infection among IDUs in 2005–2006. Our small sample size and the nonrandom selection of countries do not permit a formal statistical comparison. However, in descriptive terms there seems to be a negative association between the incidence of diagnosed HIV infection in IDUs and the availability of opioid substitution treatment and needle-and-syringe programs, suggesting that wider availability of opioid substitution treatment and needle-and-syringe programs may have contributed to preventing HIV infections.

It would be difficult to interpret these data causally. We have presented a cross-sectional, ecological description of highly aggregated data, and we were unable to control for differences in data quality or possible confounding factors. Data quality differences include differences in the various countries' HIV surveillance systems, and for 2 countries a different definition of coverage of needle-and-syringe programs. Confounding factors may include differences within and between countries in the following areas: HIV testing practices, quality and completeness of HIV testing and case reporting, prevalence and incidence of injection drug use, drug policies (particularly the extent of repressive measures), patterns of drug use, and patterns of risk behavior. Indeed, the estimates suggest that there may be a lower prevalence of IDUs in the EU and a higher prevalence in Russia. On the other hand, a high level of opioid substitution treatment provision may have contributed to reductions in IDU prevalence in the EU,[6,7] along with other factors such as drug market availabilities and preferences. It seems further unlikely that HIV testing rates among IDUs would be lower in areas with a higher availability of opioid substitution treatment and needle-and-syringe programs.

These data point to critical differences in responses to HIV among IDUs, suggesting a need for stronger international consensus regarding evidence-based policies. The large-scale implementation of harm-reduction measures in some of these countries has apparently not led to increased prevalence of drug injection or HIV, contrary to claims that have been made at high-level drug-policy meetings.[36] Harm-reduction measures are also valuable for their broader public health impact beyond HIV prevention, including the prevention of other infectious diseases, such as HCV; improving IDUs' access to HIV treatment, drug-use treatment, and general health care; and reducing criminal activity among IDUs. ■

About the Authors

At the time of the study, Lucas Wiessing, Danica Klempová, Dagmar Hedrich, and Paul Griffiths were with the European Monitoring Centre for Drugs and Drug Addiction, Lisbon, Portugal. Giedrius Likatavičius and Anthony Nardone were with EuroHIV, Department of Infectious Diseases, Institut de Veille Sanitaire, St Maurice, France.

Correspondence should be sent to Lucas Wiessing, European Monitoring Centre for Drugs and Drug Addiction, Rua da Cruz de Santa Apolónia 23-25, 1149-045 Lisbon, Portugal (e-mail: Lucas.Wiessing@emcdda.europa.eu).

This brief was accepted October 18, 2008.

Contributors

L. Wiessing researched all data and wrote the article. L. Wiessing, D. Klempovā and P. Griffiths developed the study concept. G. Likatavičius, D. Klempová, D. Hedrich, and A. Nardone provided parts of the data and contributed to the data research. All authors discussed all versions of the article.

Acknowledgments

We thank Colin Taylor and Andre Noor for statistical advice.

Human Participant Protection

No protocol approval was necessary because data were obtained from secondary sources.

References

1. Des Jarlais DC, Marmor M, Paone D, et al. HIV incidence among injecting drug users in New York City syringe-exchange programmes. *Lancet.* 1996;348:987–991.

2. Ball AL, Rana S, Dehne KL. HIV prevention among injecting drug users: responses in developing and transitional countries. *Public Health Rep.* 1998;113(suppl 1): 170–181.

3. Sarang A, Stuikyte R, Bykov R. Implementation of harm reduction in Central and Eastern Europe and Central Asia. *Int J Drug Policy.* 2007;18:129–135.

4. Hammett TM, Wu Z, Duc TT, et al. "Social evils" and harm reduction: the evolving policy environment for human immunodeficiency virus prevention among injection drug users in China and Vietnam. *Addiction.* 2008;103(1):137–145.

5. Van Den Berg C, Smit C, Van Brussel G, Coutinho R, Prins M. Full participation in harm reduction programmes is associated with decreased risk for human immunodeficiency virus and hepatitis C virus: evidence from the Amsterdam Cohort Studies among drug users. *Addiction.* 2007;102:1454–1462.

6. Committee on the Prevention of HIV Infection Among Injecting Drug Users in High-Risk Countries. *Preventing HIV Infection Among Injecting Drug Users in High-Risk Countries: An Assessment of the Evidence.* Washington, DC: National Academy of Sciences; 2007. Available at: http://www.nap.edu/catalog/11731. html. Accessed April 5, 2009.

7. Palmateer N, Kimber J, Hickman M, Hutchinson S, Rhodes T, Goldberg D. *Evidence for the Effectiveness of Harm Reduction Interventions in Preventing Hepatitis C Transmission Among Injecting Drug Users: A Review of Reviews. Executive Summary.* Glasgow, Scotland: Health

Protection Scotland; 2008. Available at: http://www.hepcscotland.co.uk/pdfs/p-Evidence-for-the-Effectivenessof-Harm-Reduction-review-EXECUTIVE%20SUMMARY-2008-05.pdf. Accessed April 5, 2009.

8. Commission on Narcotic Drugs, United Nations Office on Drugs and Crime, United Nations Economic and Social Council. Responding to the prevalence of HIV/AIDS and other blood-borne diseases among drug users. Report presented at: Commission on Narcotic Drugs 51st Session; March 10–14, 2008; Vienna, Austria. Available at: http://daccessdds.un.org/doc/UNDOC/GEN/V08/501/78/PDF/V0850178.pdf?OpenElement. Accessed March 7, 2008.

9. Wiessing LG, Denis B, Guttormsson U, et al. Estimating coverage of harm-reduction measures for injection drug users in Europe. Paper presented at: Global Research Network on HIV Prevention in Drug-Using Populations Third Annual Meeting; July 5–7, 2000; Durban, South Africa. Available at: http://www.emcdda.europa.eu/?fuseaction=public.AttachmentDownload&nNodeID=1527. Accessed February 15, 2008.

10. Mathers B, Degenhardt L, Phillips B, et al. Global epidemiology of injecting drug use and HIV among people who inject drugs: a systematic review. *Lancet.* 2008;372(9651):1733–1745.

11. *HIV/AIDS, Viral Hepatitis and Sexually Transmissible Infections in Australia Annual Surveillance Report 2007.* Darlinghurst, Australia: National Centre in HIV Epidemiology and Clinical Research; 2007. Available at: http://www.nchecr.unsw.edu.au/NCHECRweb.nsf/resources/SurvRep07/$file/ASR2007.PDF. Accessed February 15, 2008.

12. *HIV/AIDS Surveillance in Europe. Mid-Year Report 2007.* Saint-Maurice, France: EuroHIV; 2007. No. 76. Available at: http://www.eurohiv.org/reports/report_76/pdf/report_eurohiv_76.pdf. Accessed February 15, 2008.

13. *HIV and AIDS in Canada: Surveillance Report to December 31, 2006.* Ottawa, Ontario: Public Health Agency of Canada; 2007. Available at: http://www.phac-aspc.gc.ca/aids-sida/publication/survreport/pdf/survrep1206.pdf. Accessed February 15, 2008.

14. *HIV/AIDS Surveillance Report, 2005.* Atlanta, GA: Centers for Disease Control and Prevention; 2007. Available at: http://www.cdc.gov/hiv/topics/surveillance/resources/reports/2005report/pdf/2005SurveillanceReport.pdf. Accessed February 15, 2008.

15. *2007 Annual Report on the State of the Drugs Problem in the European Union.* Lisbon, Portugal: European Monitoring Centre for Drugs and Drug Addiction; 2007. Available at: http://www.emcdda.europa.eu/html.cfm/index44682EN.html. Accessed February 15, 2008.

16. Wiessing L, Nardone A. Ongoing HIV and viral hepatitis infections in IDUs across the EU, 2001–2005. *Euro Surveill.* 2006;11(47). Available at: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=3084.

17. Hedrich D, Pirona A, Wiessing L. From margin to mainstream: the evolution of harm reduction responses to problem drug use in Europe. *Drugs Educ Prev Policy.* 2008;15(6):503–517.

18. Sendziuk P. Harm reduction and HIV-prevention among injecting drug users in Australia: an international comparison. *Can Bull Med Hist.* 2007;24:113–129.

19. Burrows D. Injecting equipment provision in Australia: the state of play. *Subst Use Misuse.* 1998;33:1113–1127.

20. Hankins CA. Syringe exchange in Canada: good but not enough to stem the HIV tide. *Subst Use Misuse.* 1998;33(5):1129–1146.

21. Loxley W. Doing the possible: harm reduction, injecting drug use and blood borne viral infections in Australia. *Int J Drug Policy.* 2000;11:407–416.

22. Razali K, Thein HH, Bell J, et al. Modelling the hepatitis C virus epidemic in Australia. *Drug Alcohol Depend.* 2007;91:228–235.

23. Bruneau J, Schechter MT. The politics of needles and AIDS. *New York Times.* April 9, 1998. Available at: http://www.mapinc.org/newscsdp/v98/n258/a05.html. Accessed April 15, 2009.

24. Popova S, Rehm J, Fischer B. An overview of illegal opioid use and health services utilization in Canada. *Public Health.* 2006;120:320–328.

25. Barnett PG, Hui SS. The cost-effectiveness of methadone maintenance. *Mt Sinai J Med.* 2000;67:365–374.

26. US FDA marketing approval for Reckitt Benckiser's Subutex & Suboxone [press release]. Slough, England: Reckitt Benckiser; October 9, 2002. Available at: http://www.reckittbenckiser.com/site/RKBR/Templates/MediaLatestNewsItem.aspx?pageid=144. Accessed December 2, 2008.

27. *Response to ASAM's Public Policy Statement on Office-Based Opioid Agonist Treatment.* New York, NY: American Association for the Treatment of Opioid Dependence; 2005. Available at: http://www.aatod.org/pdfs/ASAM_Policy_Comm_March_05_2.pdf. Accessed March 3, 2008.

28. Syringe exchange programs. Atlanta, GA: Centers for Disease Control and Prevention; December 2005. Available at: http://www.cdc.gov/idu/facts/aed_idu_syr.htm. Accessed February 15, 2008.

29. Access to sterile syringes. Atlanta, GA: Centers for Disease Control and Prevention; December 2005. Available at: http://www.cdc.gov/idu/facts/aed_idu_acc.htm. Accessed February 15, 2008.

30. Tempalski B, Cooper HL, Friedman SR, Des Jarlais DC, Brady J, Gostnell K. Correlates of syringe coverage for heroin injection in 35 large metropolitan areas in the US in which heroin is the dominant injected drug. *Int J Drug Policy.* 2008;19(suppl 1):S47–S58.

31. Aceijas C, Hickman M, Donoghoe MC, Burrows D, Stuikyte R. Access and coverage of needle and syringe programmes (NSP) in Central and Eastern Europe and Central Asia. *Addiction.* 2007;102:1244–1250.

32. Perriens J. A global perspective on scaling up harm reduction. Paper presented at: 2nd National Harm Reduction Conference of the World Health Organization; March 21–23, 2007; Kiev, Ukraine. Available at: http://www.who.int/hiv/idu/JPerriens_globalIDU.ppt. Accessed March 3, 2008.

33. Sarang A, Rhodes T, Platt L. Access to syringes in three Russian cities: implications for syringe distribution and coverage. *Int J Drug Policy.* 2008;19(suppl 1):S25–S36.

34. Bruce RD, Dvoryak S, Sylla L, Altice FL. HIV treatment access and scale-up for delivery of opiate substitution therapy with buprenorphine for IDUs in Ukraine—programme description and policy implications. *Int J Drug Policy.* 2007;18:326–328.

35. Pharmacy sales of sterile syringes. Atlanta, GA: Centers for Disease Control and Prevention; December 2005. Available at: http://www.cdc.gov/idu/facts/aed_idu_phar.htm. Accessed February 15, 2008.

36. Transnational Institute. 2005 CND debate. UNGASS 10-Year Review Web site. Available at: http://www.ungassondrugs.org/index.php?option=com_content&;task=blogcategory&id=56&Itemid=102. Accessed September 21, 2008.